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PIC/JR-1023/61

June 1961

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# MICROWAVE STATIONS WITHIN A 100-KILOMETER RADIUS OF MOSCOW

ARMY NAVY CIA



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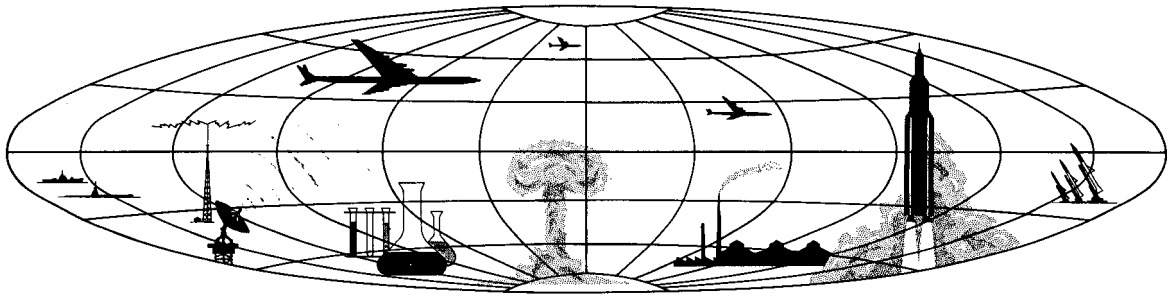
PHOTOGRAPHIC INTELLIGENCE CENTER



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# MICROWAVE STATIONS WITHIN A 100-KILOMETER RADIUS OF MOSCOW

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# PREFACE

This joint photographic intelligence report has been prepared by the Army, Navy, and Central Intelligence Agency, under CIA chairmanship, in answer to requirements requesting an analysis of microwave facilities within a 50-nautical-mile radius of Moscow. Distances used in this report are from the Kremlin, and have been expressed in kilometers to facilitate easier collation with information from collateral sources.

Information in this report is based on an analysis of aerial and ground photography and has been supplemented by data from numerous collateral reports. A helpful analysis of these reports through 1958 was prepared by the Radio Stations Branch, OCR/CIA. Numbers have been assigned to all microwave stations for convenient map and table reference. Both geographic and UTM coordinates are given for station locations. The UTM coordinates are from AMS map Series N501, scale 1:250,000.

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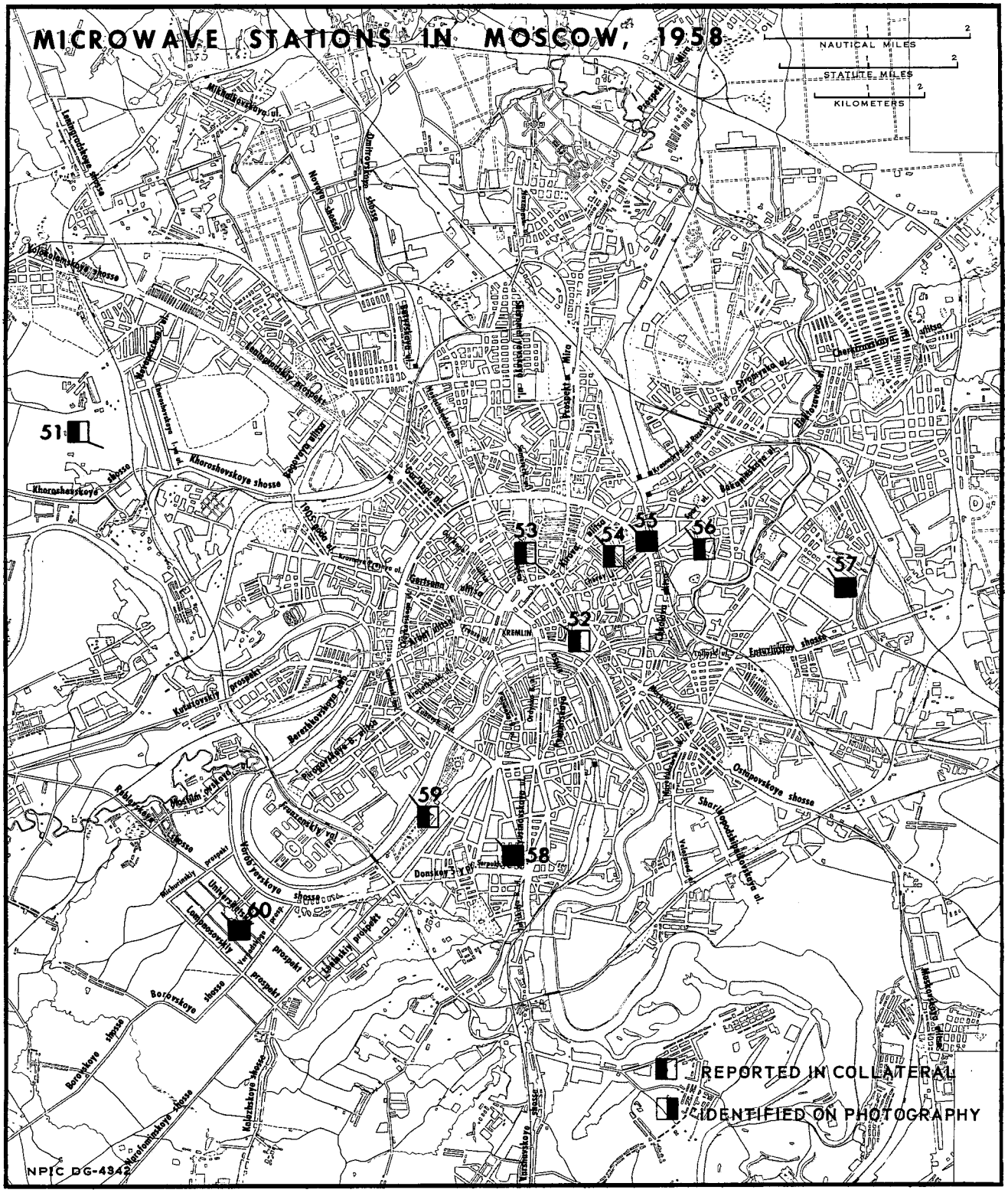


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## SUMMARY

This report is a comprehensive analysis, based on aerial and ground photography and collateral sources, of 60 microwave stations within a 50-nautical-mile radius of Moscow. About half of this area is covered by aerial photography of [redacted] but less than one fourth of this coverage is usable. Of the 60 stations, 3 have been identified on this photography. No stations have been identified on World War II aerial photography. However, ground photography dated 1953 to 1958 is available on 25 stations. The remaining 32 stations are reported in collateral sources. This report consists of a general description of various types of Soviet microwave stations, tabular data on all 60 stations, ground photography showing various designs of microwave antennas, and two maps showing station locations within the Moscow area (see page 4 and inside back cover).

Before World War II, microwave radio-relay communications were practically nonexistent in the USSR except for experimental use. After the war, the USSR began to give increasing importance to radio-relay communications. The first microwave relay line, which linked Moscow with Gorkiy and reportedly handled eight telephone channels, was built at that time. However, there was no extensive development of such lines until 1954-56, in which period more than 1,100 kilometers of radio-relay lines were put in operation. In addition to the Moscow/Gorkiy link, there were as of 1958 probably five additional links, one each from Moscow to and through the cities of Yaroslavl, Ryazan, Tula, Bryansk, and Smolensk.

Relay points in the USSR are usually placed approximately 50 to 60 kilometers apart, but the distance varies, depending on the equipment used and obstacles in the line-of-sight. Thus, there may be only one station of a particular link located within 50 nautical miles (93 kilometers) of Moscow. No attempt is made in this report to associate individual stations with particular links. Several stations appear to be terminal stations constructed solely for communication between a probable control center or headquarters in Moscow and a particular installation outside the city. Examples of such

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stations are Station 22 at Domodedovo Antenna Farm, Station 40 at Vnukovo Airfield, and Station 55 in Moscow.

The following is a description of some of the various types of microwave masts, towers, and antennas in the Moscow area identified from ground photography. One type of microwave equipment frequently seen on this photography is the Strela-M, which is capable of handling 24 telephone channels. A Strela-M relay station usually includes a self-supporting steel tower and two circular flat-surfaced reflectors suspended from a platform mounted on the top of the tower (see photograph, Figure 1A).

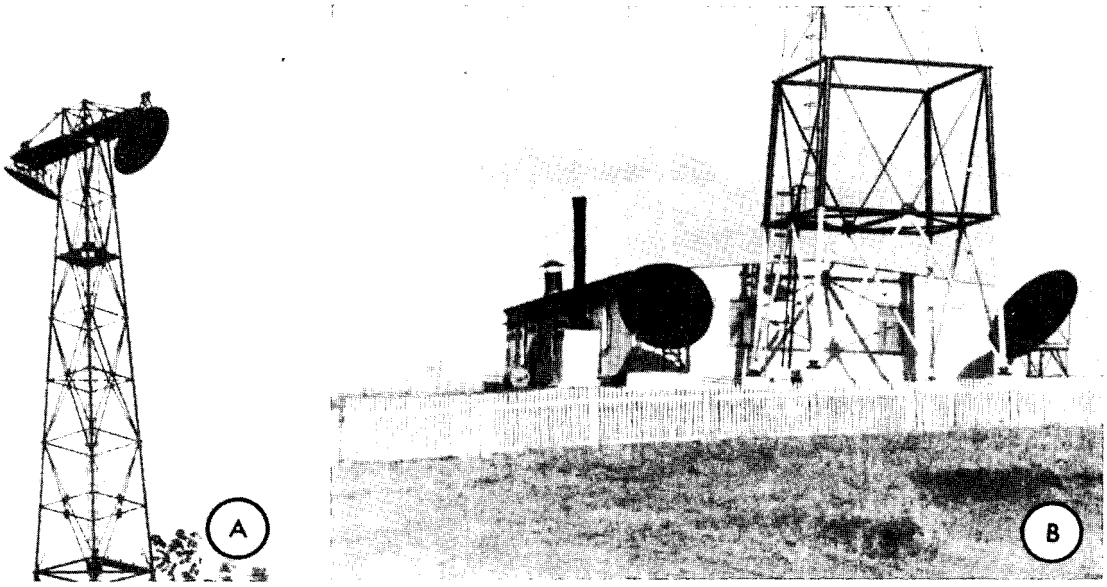


*FIGURE 1. STRELA-M RELAY EQUIPMENT - Located at the 130 km marker on the Moscow-Opel highway (1958).*

The reflectors are inclined at an angle of 45 degrees and are oriented in opposite directions. On the ground and immediately below the circular reflectors are two parabolic reflectors inclined at 45 degrees. Located on a line-of-sight to the parabolic reflectors are two horn-type antennas which project from a nearby building that houses the radio-relay apparatus (see photograph, Figure 1B). Strela-M equipment has been identified along the routes of most of the reported Moscow links.

Equipment used at Station 26 includes two circular flat-surface reflectors and two corner reflectors supported by a self-supporting steel

tower. The circular reflectors are mounted near the top of the tower, and the corner reflectors are mounted below the top. One circular reflector is attached directly to the tower, and the other is supported by two steel arms extending about three feet off the side of the tower. Both circular reflectors are oriented in the same direction. The two corner reflectors are stacked one above the other and are oriented in the opposite direction from the circular reflectors. The photographs, Figure 2, show the station of June 1958 at which time it did not have the circular reflector attached by the steel arms. By September 1958 it had been installed.

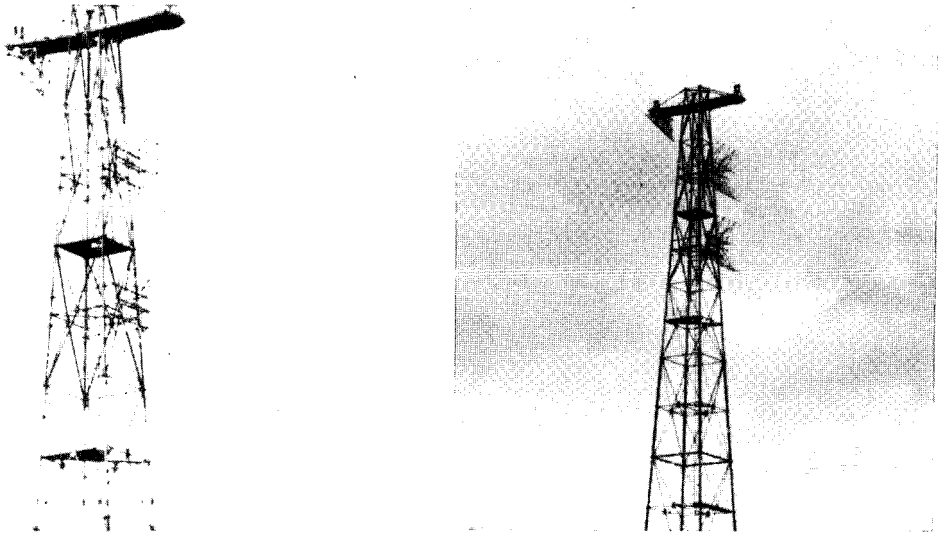

*FIGURE 2. FLAT SURFACED REFLECTOR AND TWO OPEN MESH CORNER REFLECTORS- Station 26, located north of Detkovo (1958).*

Station 21, near Borisovo, employs a parabolic open-mesh reflector and two horn and lens reflectors mounted on top of a self-supporting steel tower. In addition, the station has an antenna of a type not previously noted, consisting of a vertical V-shaped mesh reflector mounted on one side of the tower and extending down the entire side. This antenna is reported to be a forward scatter antenna, but it may be a stacked corner reflector (see photograph, Figure 3). Station 60 has two large reflectors mounted side by side atop the clock tower of the university (see photographs, Figure 4). These two reflectors are oriented toward Station 42, which has two similar horn and lens reflectors mounted atop a building near Kobyakovo

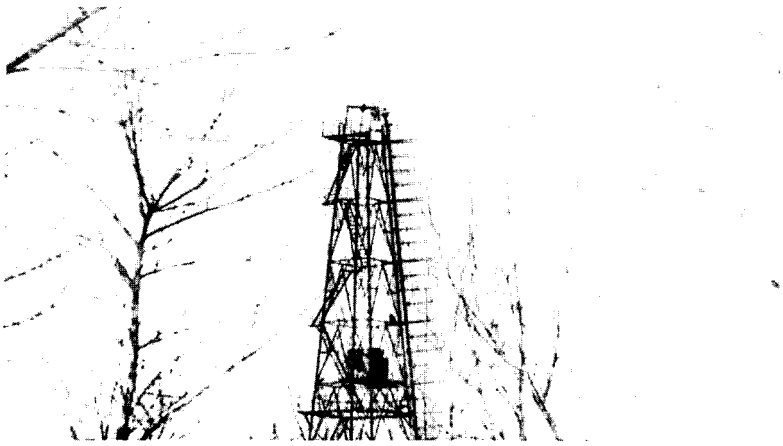

*FIGURE 3. PARABOLIC OPEN MESH REFLECTOR, TWO HORN AND LENS REFLECTORS, AND ONE POSSIBLE STACKED CORNER REFLECTOR - Station 21, located near Borisovo (1958).*

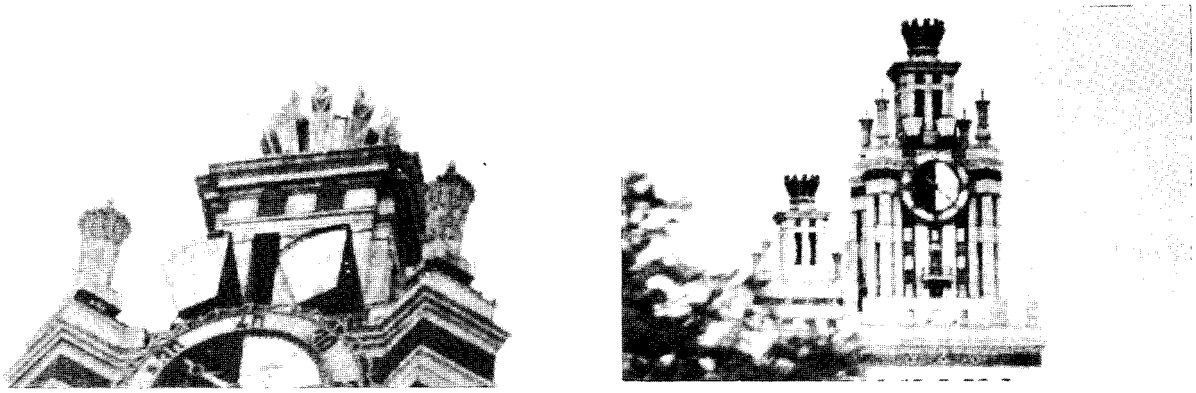

*FIGURE 4. HORN AND LENS TYPE REFLECTORS - Station 60, located on clock tower of Moscow University (1958).*

(see photograph, Figure 5). Also in the same immediate area is a reported "goalpost" antenna array and a circular microwave reflector inclined at a 45-degree angle and mounted on one side of a guyed steel tower. Other types of microwave equipment noted in the Moscow area are stacked dipoles with plane reflectors (see photograph, Figure 6) and solid parabolic reflectors (see photograph, Figure 7).

Ground photography and collateral data indicate that research on and development of microwave antennas are being conducted at the Moscow Military Communications Institute near Mytishchi. This institute is re-

ported to be the most important Soviet Army communications research institute conducting research on radar, telephone, microwave, and other equipment. Ground photography shows microwave antennas of various

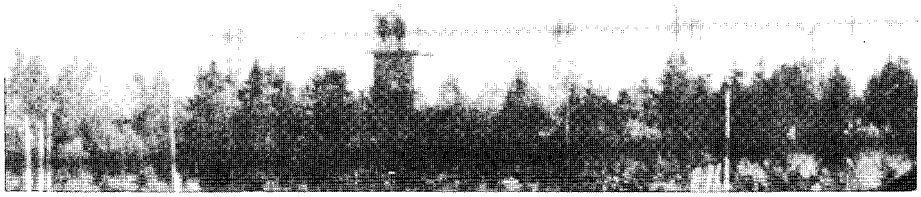

*FIGURE 5. TWO HORN AND LENS REFLECTORS, ONE CIRCULAR FLAT SURFACED REFLECTOR, AND ONE REPORTED "GOAL POST" ARRAY - Station 42, located near Kobyakovo (1958).*

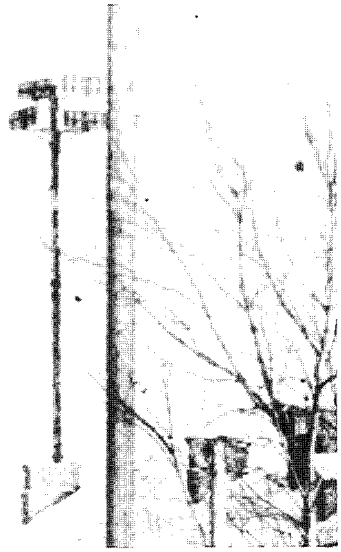

*FIGURE 6. FOUR STACKED DIPOLES WITH PLANE REFLECTORS - Station 9, located near Moscow/Izmaylovo Airfield (1956).*

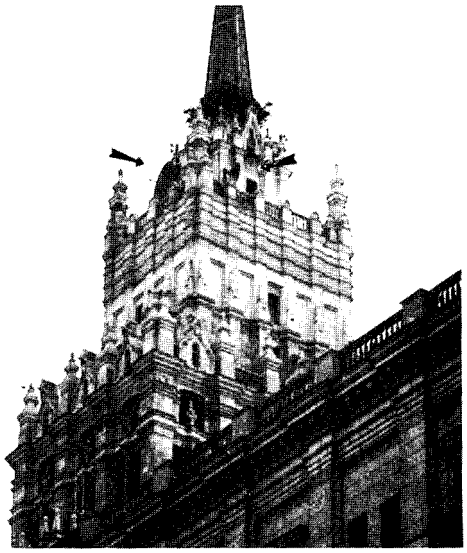

*FIGURE 7. TWO SOLID PARABOLIC REFLECTORS - Station 55, located on the building housing the Ministry of Transport Machine building (1958).*

types mounted on either guyed masts or self-supporting towers, dispersed over the institute grounds (see photographs, Figure 8).

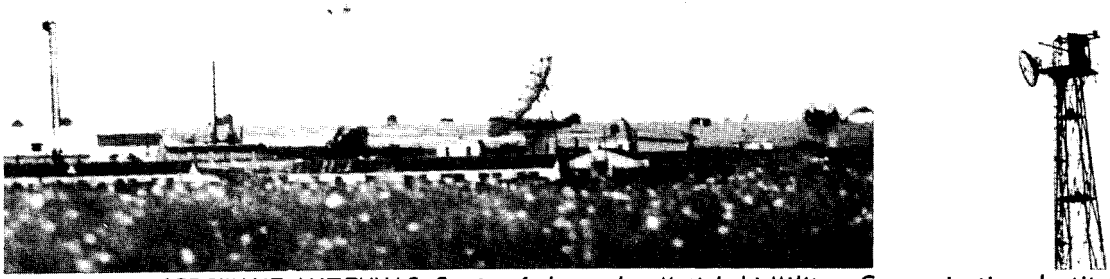

*FIGURE 8. MICROWAVE ANTENNAS - Station 6, located at Mytishchi Military Communications Institute (1958).*

Photography and collateral reports were studied to determine whether any microwave stations are associated with the Moscow SAM sites. A microwave antenna has been reported near each of three Yo-Yo radar bunkers associated with Moscow SAM sites. Two reports described a rectangular decimetric dipole antenna (one at Station 18 and one at Station 35). One report described a parabolic reflector ( at Station 25). However, ground photography shows that what is reported is probably the boresight pole and reflector found at all Yo-Yo radar sites. No photography is available on the reported parabolic reflector, but its location indicates it may also be a boresight pole. There are no additional indications from photography or collateral reports that other microwave facilities are located at or near any of the Moscow SAM sites.

No microwave stations have been identified on World War II aerial photography of the Moscow area. The fact that 60 microwave stations have been reported and/or identified on photography as of [redacted] within 50 nautical miles of Moscow, is evidence that the USSR has made significant progress in the development and use of microwave communications.

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The table on the following pages presents data on the 60 microwave stations covered in this report. The type and height of antenna supports and the type and orientation of antennas are given when known.

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# MICROWAVE STATIONS WITHIN A

| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 1 | 83 km NE of Moscow near Rogachevo | 56°25'N/38°17'E 37UDC550522 | Reported probable microwave tower one mile E of Moscow/ Yaroslavl road at 88 km marker. |
| 2 | 73 km NNE of Moscow near Zagorsk | 56°19'N/38°14'E 37UDC528409 | Reported microwave relay tower. |
| 3 | 65 km NE of Moscow near Ryazantsy | 56°14'N/38°06'E 37UDC446324 | Ground photography shows 2 parabolic reflectors mounted on a guyed steel mast. |
| 4 | 48 km NNE of Moscow on Moscow/Zagorsk highway | 56°09'N/38°00'E 37UDC375235 | Reported microwave tower may be used in conjunction with a field exercise. |
| 5 | 26.8 km NNE of Moscow near Tarasovka | 55°58'N/37°49'E 37UDC262025 | Two reported Bed Rest microwave antennas. |

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# 100-KILOMETER RADIUS OF MOSCOW

| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| — — — | — — — | [redacted] | |
| Sectional steel mast, 200' | Possible parabolic reflector | | |
| Guyed steel lattice mast | 2 parabolic reflectors | | |
| Steel mast, approx. 60' | 4 parabolic reflectors mounted in pairs, approx. [redacted] oriented SW | | |
| Mast, 40' | Possible stacked dipole with plane reflector | | |

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| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 6 | 20.3 km NNE of Moscow, just NW of Mytishchi | 55°56'N/37°44'E 37UDB213985 | This installation is the Mytishchi Military Communications Institute. The mast with 2 parabolic reflectors probably is the microwave terminal station for the institute. The remaining microwave antennas probably serve no other function than research and development. |
| 7 | 15 km N of Moscow near Vatutino | 55°53'N/37°40/E 37UDB167945 | Reported microwave relay station. |
| 8 | 13 km NNE of Moscow at Babushkin | 55°52'N/37°42'E 37UDB191911 | Ground photography shows microwave station at Babushkin Radio Station consisting of a tall guyed steel mast topped with two horn reflectors. |
| 9 | 13.8 km NE of Moscow on the N side of Shchelkovskoye Shosse | 55°49'N/37°49'E 37UDB256858 | Ground photography shows 4 stacked dipole antennas on 50' mast opposite NE side of Izmaylovo A/F. |

| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| 25X1D | | | 25X1D |
| 4 guyed steel masts, 60'<br>1 guyed steel mast, 60'<br>1 self-supporting steel tower<br>1 self-supporting steel tower<br>1 self-supporting steel tower, 250'<br>1 mast | 4 parabolic reflectors, [redacted] dia.<br>1 horn reflector<br>1 parabolic reflector<br>1 mesh parabolic reflector<br>2 parabolic reflectors, [redacted] dia.<br>2 parabolic reflectors, oriented S | [redacted] | |
| 25X1D | | | |
| Sectional steel mast, 200' | Possible parabolic reflector | | |
| Guyed steel mast | 2 horn reflectors | | |
| Guyed mast, 50' | 4 stacked dipole arrays with plane, reflectors, 2 oriented W and 2 S | | |

| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 10 | 12 km ENE of Moscow and just S of Izmaylovo A/F | 55°47'N/37°48'E 37UDB243845 | Ground photography shows a guyed steel mast with parabolic reflector. |
| 11 | 22 km E of Moscow at Balashikha | 55°49'N/37°57'E 37UDB344867 | Reported terminal station. |
| 12 | 20.1 km E of Moscow at Nikolayevka | 55°48'N/38°56'E 37UDB335840 | Two reported back-to-back Bed Rest antennas mounted on a 40' mast located at an antenna farm in Nikolayevka. |
| 13 | 25.9 km E of Moscow near Novaya | 55°48'N/38°01'E 37UDB396856 | Two reported back-to-back Bed Rest antennas on a mast at an antenna farm near Novaya. |
| 14 | 11 km E of Moscow at Perovo | 55°46'N/37°47'E 37UDB237778 | Reported probable dipole array on steel mast in Perovo. |
| 15 | 19 km SE of Moscow at Panki | 55°40'N/37°54'E 37UDB303695 | Possible stacked dipole array on guyed mast. |

| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Guyed steel mast | Parabolic reflector | [redacted] | |
| Self-supporting steel tower | Antenna oriented E | | |
| Mast, 40' | 2 stacked dipole arrays with plane reflectors mounted back to back, oriented W-E | | |
| Mast | 2 stacked dipole arrays with plane reflectors mounted back to back, oriented W-E | | |
| Steel mast, 75' | Probable stacked dipole array with plane reflector, oriented W | | |
| Guyed mast | Possible stacked dipole array with plane reflector | | |

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| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 16 | 20 km SE of Moscow near Kotel'niki | 55°38'N/37°52'E 37UDB290670 | Reported possible decimetric array mounted on top of a building. |
| 17 | 58.3 km SE of Moscow near Bronnitsy Station | 55°30'N/38°22'E 37UDB595515 | This installation is reported as a repeater station in the Moscow Ryazan microwave link. Strela-M equipment is reportedly being used at this site. |
| 18 | 79 km SE of Moscow and 25 km SE of Konobeyevo | 55°22'N/38°42'E 37UDB805373 | Ground photography shows a possible reflector on a mast at Moscow SAM site M-63. This antenna is probably the boresight for the Yo-Yo radar. |
| 19 | 85 km SE of Moscow just N of Voskresenskoye | 55°19'N/38°42'E 37UBD806310 | Reported rectangular antenna 100 yards E of Moscow/ Kolomna rail line. |
| 20 | 94.5 km SE of Moscow just N of Peski | 55°13'N/38°46'E 37UDB857197 | Reported microwave relay station in the Moscow/Ryazan link using Strela-M equipment. |
| 21 | 16 km SSE of Moscow near Borisovo | 55°38'N/37°43'E 37UDB185660 | Ground photos show tall self-supporting tower with an open mesh parabolic reflector and 2 horn and lens antennas at the top. A V-shaped possible stacked corner reflector, reported as a forward scatter antenna, extends the length of the tower. |

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| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| 4 masts atop building | One antenna oriented W and 3 NW | [redacted] | 25X1D |
| Self-supporting steel tower, 120' | 4 circular reflectors, one oriented NW and one SE | | |
| Mast, 40' | Possible parabolic reflector | | |
| Mast, 25' | Probable stacked dipole array with plane reflector, [redacted] | | |
| 25X1D | | | |
| Self-supporting steel tower, 210' | 4 circular reflectors | | |
| Self- supporting steel tower, 120' | 1 mesh parabolic reflector, oriented N | | |
| 25X1D | 2 horn and lens reflectors, [redacted] oriented S | | |
| 25X1D | 1 V-shaped possible stacked corner reflector [redacted] oriented ENE | | |

| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 22 | 32 km SSE of Moscow and just S of Starry Yam | 55°28'N/37°46'E 37UDB218478 | Ground photography shows a parabolic reflector mounted on a 60' tower at Domodedovo Antenna Farm. This is probably a microwave terminal for the Antenna Farm. |
| 23 | 18.5 km S of Moscow near Starrye Bittsy | 55°35'N/37°34'E 37UDB108618 | Reported microwave relay station. Ground photography shows guyed steel masts with two parabolic reflectors mounted on top. |
| 24 | 24 km S of Moscow and just SW of Butovo | 55°32'N/37°33'E 37UDB091552 | Reported decimeter relay possibly located at Butovo Antenna Farm. Ground photography shows probable guyed steel mast, but limited resolution precludes identification of antennas. |

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| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Guyed sectional steel tower, approx. 60' | 1 parabolic reflector | [redacted] | |
| Guyed steel mast, 150-175' | 2 parabolic reflectors, [redacted] one oriented N and one E | | |
| Probable guyed steel mast, 300' | 2 parabolic reflectors, 1 horn reflector | | |

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| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 25 | 48 km S of Moscow near Romantsero | 55°19'N/37°36'E 37UDB109303 | Reported mast with dish reflectors near a Yo-Yo radar site. This is possibly a boresight pole associated with the Yo-Yo radar. |
| 26 | 59 km S of Moscow just N of Detkovo | 55°14'N/37°30'E 37UDB047219 | Reported Strela-M repeater station on Moscow/Serpukhov link. Ground photography shows two circular, flat-surfaced reflectors inclined at 45° oriented in same direction and two stacked corner reflectors mounted on self-supporting steel tower. |
| 27 | 84 km S of Moscow and 5 km N of Serpukhov | 55°58'N/37°26'E 37UDA003920 | Reported microwave tower on Moscow/Voronezh link. |
| 28 | 94.5 km S of Moscow at Serpukhov | 54°53'N/37°27'E 37UDA006843 | Ground photography shows self-supporting steel tower with two circular flat surfaced reflectors inclined at an angle of approximately 45°. This is probably a Strela-M repeater station. |

| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Mast | Possible parabolic reflector | [redacted] | |
| Self-supporting steel tower, approx. 150' | 2 circular flat-surfaced reflectors<br>2 corner reflectors | | |
| — — — | — — — | | |
| Self-supporting steel tower | 2 circular flat-surfaced reflectors | | |

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| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 29 | 101 km S of Moscow and 5 km S of Serpukhov | 54°51'N/37°26'E 37UCA996804 | Reported Strela-M station on Moscow/Voronezh link. Ground photography shows two parabolic reflectors inclined at an angle of 45°. One reflector is mounted on top of the guyed steel mast and another is mounted halfway up on the side of the mast. |
| 30 | 33.3 km SW of Moscow near Vatutinki | 55°30'N/37°23'E 37UCB954520 | Reported microwave station at radio station near Vatutinki. Two 60' masts, one with 2 parabolic reflectors and one with 2-stacked dipole arrays, were sighted. |
| 31 | 32.4 km SW of Moscow and just S of Desna | 55°30'N/37°20'E 37UCB947528 | Reported microwave station consisting of 1 parabolic reflector [redacted] diameter mounted on a 25' mast. |
| 32 | 18 km SSW of Moscow near Teplyy Stan | 55°37'N/37°30'E 37UDB060643 | Ground photography shows 2 guyed steel masts, with 2 parabolic reflectors mounted on each, located at Teplyy Sten Antenna Farm. |
| 33 | 118 km SW of Moscow near Yerdenevo | 55°55'N/36°28'E 37UCA378885 | Reported microwave relay station. Ground photography shows one probable steel mast with U/I object mounted on top. |

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| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Guyed sectional steel mast | 2 parabolic reflectors | [redacted] | 25X1D |
| Mast, 60' | 2 parabolic reflectors | | |
| Mast, 60' | 2 stacked dipole arrays with plane reflectors | | |
| 25X1D | | | |
| Mast, 25' | 1 parabolic reflector, [redacted] dia., oriented SE | | |
| 2 guyed steel masts | 2 parabolic reflectors on each mast, oriented WSW and NNE on other mast | | |
| Probable steel mast | — — — | | |

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| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 34 | 97 km SW of Moscow near Station Obninskoye | 55°06'N/36°36'E 37UCB470080 | Reported microwave relay station. |
| 35 | 82.5 km SW of Moscow and just N of Vorsino | 55°15'N/36°40'E 37UCB527253 | Ground photography shows a guyed mast with possible reflector similar to boresights found at all Yo-Yo radar bunkers associated with each Moscow SAM site. |
| 36 | 61 km SW of Moscow and 3.8 km E of Bekosovo | 55°25'N/36°52'E 37UCB657443 | Reported possible decimetric horns 2,000 yards SE of RR tracks near Bekosovo. |
| 37 | 61 km SW of Moscow just N of Bekosovo | 55°26'N/36°49'E 37UCB630454 | Reported probable microwave relay link 700 yards NW of RR track at Bekosovo. |
| 38 | 45 km SW of Moscow just E of Burtsevo | 55°32'N/37°01'E 37UCB752574 | Reported probable microwave relay link 1,000 yards NW of RR line. |
| 39 | 40.5 km SW of Moscow and just N of Aprelevka | 55°34'N/37°04'E 37UCB784598 | Reported probable microwave relay link 1 mile NW of RR track near Aprelevka. Identified on [redacted] aerial photography. |
| 40 | 26 km SW of Moscow at Vnukovo A/F | 55°36'N/37°17'E 37UCB923639 | Reported microwave antenna of the type associated with RVg 903 equipment mounted on a 20' mast atop a 3-story building at Vnukovo A/F. This is probably a terminal microwave station for the A/F. |

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| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| — — — | — — — | [redacted] | |
| Guyed mast, 30-40' | Possible reflector | | |
| Mast | Possible horns | | |
| — — — | — — — | | |
| — — — | — — — | | |
| Possible lattice mast, approx. 135' | — — — | | |
| Mast atop 3-story building, 20' | 3 stacked dipole arrays with plane reflectors, top array oriented NE; other two arrays oriented NW-SE | | |

| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 41 | 25 km SW of Moscow near Odintsovo | 55°39'N/37°15'E 37UCB903689 | Ground photography shows guyed lattice mast with horn and lens antenna oriented NW. This probably is a terminal for the radar installation near Odintsovo. |
| 42 | 41.5 km SW of Moscow and just S of Sidorovskaye | 55°35'N/37°02'E 37UCB756623 | Ground photography shows 2 horn and lens reflectors mounted atop building and oriented toward microwave station 60. Nearby a circular flat-surfaced reflector inclined at 45° is mounted near the top of a guyed 80' steel tower. |
| 43 | 42.5 km WSW of Moscow near Malaya Vyazema | 55°37'N/37°01'E 37UCB749666 | Reported microwave link with two horns 800 yards N of RR track near Malaya Vyazema. |
| 44 | 44.5 km WSW of Moscow and just SW of Golitsyno | 55°36'N/36°58'E 37UCB718639 | Reported 100' mast topped with 2 probable stacked dipole arrays with plane reflectors. An unusual protrusion shaped like a half moon was noted two thirds of the way up the mast. |
| 45 | 83 km WSW of Moscow and just W of Dorokhovo | 55°33'N/36°21'E 37UCB331595 | Reported Strela-M microwave relay station on Moscow/ Smolensk link. |

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| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Guyed steel lattice mast | Horn and lens, oriented NW | [redacted] | 25X1D |
| Guyed steel lattice tower, approx 80'<br>Square brick building approx. 20' | 1 circular flat surfaced reflector, oriented NE<br>2 horn and lens reflectors, 10', oriented NE | | |
| — — — | 2 horns | | |
| Mast, 100' | 2 probable stacked dipole arrays with plane reflectors | | |
| — — — | — — — | | |

| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 46 | 85 km WSW of Moscow near Grubtsovo | 55°30'N/36°25'E 37UCB335550 | Aerial photography of [redacted] shows self-supporting steel tower. Probable microwave relay station. 25X1D |
| 47 | 90 km WSW of Moscow near Novo-Nikolskoye | 55°27'N/36°19'E 37UCB300495 | Aerial photography of [redacted] shows self-supporting steel tower. Probable microwave relay station. |
| 48 | 23 km NW of Moscow near Chernevo | 55°50'N/37°16'E 37UCB922889 | Ground photography shows two possible microwave horn reflectors mounted on a sectional steel mast at Chernevo Radio Station. |
| 49 | 21.5 km NW of Moscow just NW of Khimki | 55°54'N/37°24'E 37UDB004968 | Ground photography shows probable microwave relay tower. |
| 50 | 15.5 km N of Moscow just NW of Boskudnikovo | 55°53'N/37°33'E 37UDB095948 | Reported possible microwave station including a possible parabolic reflector atop a 100' steel lattice mast. |
| 51 | 9.2 km NNW of Kremlin and 2.8 km W of Central A/F | 55°47'N/37°29'E 37UDB052830 | Two of three reported probable stacked dipole arrays with plane reflectors atop a building at Oktyabr'skiy Antenna Farm. |
| 52 | 0.9 km E of Kremlin Vladimirova Ulitsa No. 9 | 55°45'N/37°38'E 37UDB140798 | Reported microwave relay station using RVG 903 equipment with 2 back-to-back stacked dipole antennas atop a 5-story building adjacent to Ministry of Agriculture. |

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25X1D

| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Self-supporting, steel tower | — — — | [redacted] | |
| Self-supporting steel tower | — — — | | |
| 1 guyed sectional steel mast | 2 possible horns | | |
| — — — | — — — | | |
| Steel lattice mast, 100' | Possible parabolic reflector | | |
| Mounted atop building | 2 or 3 probable stacked dipole arrays with plane reflectors | | |
| Mast atop 5-story building, 20' | 2 probable stacked dipole arrays with plane reflectors mounted back to back, oriented SE to NW | | |

| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 53 | 1.1 km NNE of Kremlin at Dzerzhinskovo Ulitsa No. 12 | 55°46'N/37°37'E 37UDB138805 | Two reported RVG 903 type stacked dipole arrays mounted on short masts atop Ministry of Internal Affairs building. |
| 54 | 2 km NE of Kremlin at Kirova Ulitsa No. 33 | 55°46'N/37°38'E 37UDB145812 | Reported RVG 903 microwave antenna located atop building. |
| 55 | 2.7 km NE of Kremlin at Sadovskaya Spasskaya No. 27 | 55°46'N/37°39'E 37UDB152814 | Reported microwave terminal for the Moscow/Ryazan link, located atop building housing the Ministry of Transport Machine. |
| 56 | 3.7 km NE of Kremlin | 55°46'N/37°40'E 37UDB165812 | Reported solid parabolic reflector mounted atop building |
| 57 | 5.8 km E of Kremlin near corner of Aviamotormaya Ulitsa and Lefortovskiy Val Ulitsa | 55°45'N/37°42'E 37UDB191804 | Reported microwave antenna atop building. |

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| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Mast | 2 stacked dipole arrays with plane reflectors, oriented SW and NNW | [redacted] | |
| — — — | 1 horn and lens reflector, oriented SW | | |
| Mounted atop building 25X1D | 3 parabolic reflectors, one [redacted] oriented SE; two 5' dia. | | |
| Mounted atop building 25X1D | Parabolic reflector, [redacted] dia. | | |
| Mounted atop building | Antenna oriented E | | |

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| NO. | LOCATION | COORDINATES | REMARKS |
|---|---|---|---|
| 58 | 2.7 km S of Kremlin on Sirotsky Per between Shobolv Ulitsa and Mytnaya Ulitsa | 55°43'N/37°36'E 37UDB131748 | Ground photography shows three parabolic reflectors mounted on side of one of two towers at Moscow Television Station. |
| 59 | 4.6 km SSW of Kremlin at Ministry of Defense buiding building | 55°43'N/37°35'E 37UDB110764 | Two reported possible stacked dipole antennas on SW corner of building housing Ministry of Defense. |
| 60 | 7.4 km S of Kremlin at Moscow State University | 55°42'N/37°32'E 37UDB078743 | Ground photography shows 2 horn and lens reflectors on the clock tower at Moscow State University. |

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25X1D

| TYPE AND HEIGHT of SUPPORT | ANTENNA TYPE, SIZE AND ORIENTATION | PHOTO COVERAGE | COLLATERAL REFERENCES |
|---|---|---|---|
| Conical steel tower, 400' | 3 parabolic reflectors | [redacted] | |
| — — — | 2 possible stacked dipole arrays with plane reflectors | | |
| Mounted on side of building | 2 horn and lens reflectors oriented WSW | | |

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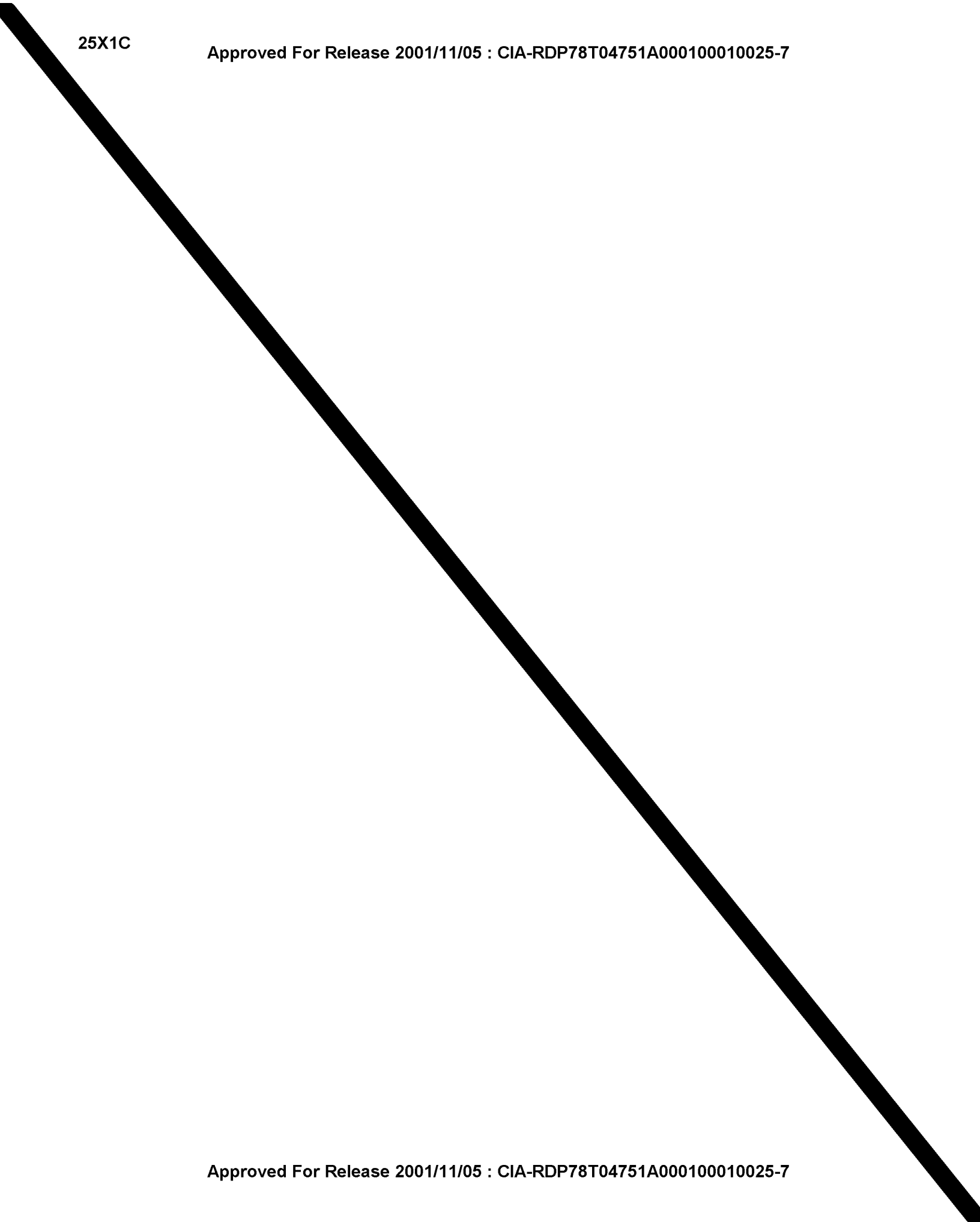

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